Using ComBase Predictor and Pathogen Modeling Program as support tools in outbreak investigation: an example from Denmark

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Using ComBase Predictor and Pathogen Modeling Program as support tools in outbreak investigation: an example from Denmark

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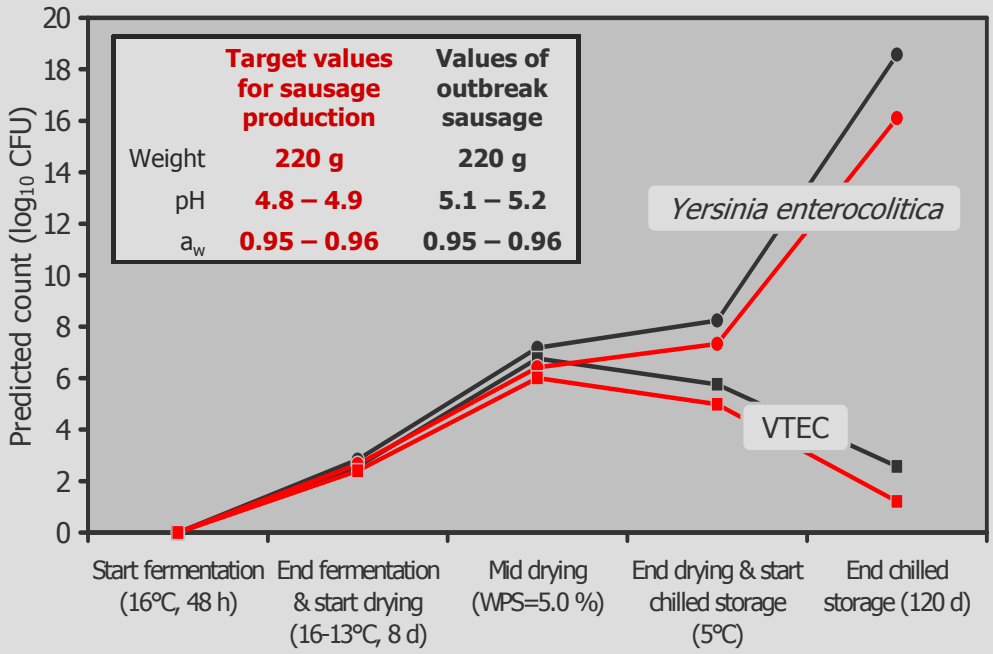
QUESTION:
Could the *Yersinia enterocolitica*, found in children suffering from VTEC O26:H11 infection, also have come from the outbreak sausage?

METHOD:
Step 1. Collecting information on intrinsic factors of sausage
Step 2. Comparing growth & reduction rates using CBP & PMP
Step 3. Predicting growth & reduction during sausage production

ANSWER:
YES! *Yersinia enterocolitica* can grow in the sausage – according to ComBase Predictor and Pathogen Modeling Program.

Step 3. Results



- Growth of both *Y. enterocolitica* as well as VTEC was possible during the fermentation and the first part of drying
- Further growth of *Y. enterocolitica* was possible in the end of drying
- Slow reduction of VTEC but growth of *Y. enterocolitica* was possible during storage
- Fermentation error could have led to an additional 1 log increase of both *Y. enterocolitica* as well as VTEC at the point of release of the outbreak sausage

Reduction in PMP 7.0

Time to 1 log decrease =
time to 5 log reduction / 5

Growth in CBP & PMP 7.0

Time to 1 log increase =
doubling time · ln(10) / ln(2)

pH
Batter pH =
pH of raw meat ⏩ pH = 5.5
Sausage pH =
Dextrose added to boost the fermentation ⏩ pH = 4.8

Nutrients

Per 100 g sausage:
Fat 9 g (F)
Protein 22 g (P)
Carbohydrates 2 g (C)

List of ingredients

For 100 g (Y) sausage:
127 g meat (M), 4 g salt (N), 2 g spices (S), 0.5 g dextrose (D), no nitrite.

Step 2. Results

Growth / reduction rates during sausage processing

Step in processing	pH	WPS (w/v %)	Temperature (°C)	Time to 1 log change (without lag) *Yersinia enterocolitica* From CBP	Time to 1 log change (without lag) VTEC From PMP
Start fermentation	5.5	3.4	24	7.1 h	6.3 h
End fermentation	4.8	3.4	24	11 h	10 h
Start drying	4.8	3.4	16	25 h	27 h
Mid drying	4.8	5.0	16	45 h	40 h
End drying	4.8	6.0	16	3 d	8 d
Chilled storage	4.8	6.0	5	15 d	26 d

Step 1. Results

Water and salt contents in batter and ready-to-eat sausage

Calculation of	Formula	Result
Weight reduction (%)	WR = 100 · ((M+N+S+D) - 100) / (M+N+S+D)	25 %
Salt content in batter (w/w %)	Nb = 100 · N / (M+N+S+D)	3.0 w/w %
Water content in batter (%)	Wb = 100 · Ws / (100 – WR)	84 %
Water phase salt in batter (w/v %)	WPSb = 100 · Nb / (Wb + Nb)	3.4 w/v %
Salt content in ready-to-eat sausage (w/w %)	Ns = 100 · N / Y	4.0 w/w %
Water content in ready-to-eat sausage (%)	Ws = 100 – (F+P+C+Ns)	63 %
Water phase salt in ready-to-eat sausage (w/v %)	WPSs = 100 · Ns / (Ws + Ns)	6.0 w/v %

DTU Food
National Food Institute

CBP: http://www.combase.cc/predictor.html
PMP: http://ars.usda.gov/Services/docs.htm?docid=11550

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